

# CIVIL ENGINEERING, BSE

Civil Engineering is a profession that deals with the infrastructure of society and impacts your everyday life. From the roads and bridges you use every day to the drinking water that comes out of your tap at home, civil engineers work to develop safe, efficient and sustainable ways to continually improve our infrastructure.

## Concentrations

- Geotechnical engineering
- Structural engineering
- Transportation and municipal engineering
- Water resources and environmental engineering

## Research

Work with faculty engaged in leading-edge research in areas such as:

- Social and environmental impacts of transportation development
- Flexible pavement design
- Fatigue and fracture mechanics
- Hydrodynamic modeling
- Environmental fluid mechanics
- Application of nanomaterials in construction

## Career Paths

Civil engineers work in all levels of government and throughout the private sector.

- Structural Designer
- Construction Manager
- City Engineer
- Stormwater Manager
- Foundation Engineer
- Resident Engineer

## Accreditation

The Civil Engineering program is accredited by the Engineering Accreditation Commission of ABET: <https://www.abet.org> (<https://tinyurl.com/u7fsfevw/>).

## New Freshmen

Admission to the College of Engineering and Applied Science is based on an overall assessment of both academic and non-academic qualifications. The primary review factors for admission are the strength and quality of the high school curriculum, high school class percentile, grade point average, and the result of the ACT or SAT. Well-prepared freshman applicants will have four years of mathematics (including one-and-a-half years of algebra, one year of geometry, and one-half year of trigonometry) and four years of natural science (including biology, chemistry, and physics). The College also will consider non-academic qualifications such as leadership skills, diversity in personal background, work experience, motivation, and maturity.

## Transfer Students

Transfer student admission is based on an overall assessment of both academic and non-academic qualifications. For transfer applicants, the

primary factors considered for admission are the grade point average on transferable courses and the level of curriculum completion. The College also will consider non-academic qualifications such as leadership skills, diversity in personal background, work experience, motivation, and maturity.

Applicants who do not meet the requirements for admission to the College of Engineering & Applied Science will automatically be considered for admission to the Pre-Engineering program in the UWM College of General Studies.

The Pre-Engineering program is an Associate degree level program offered jointly by the College of General Studies and the College of Engineering & Applied Science. The curriculum is designed to prepare students for the engineering program with emphasis on mathematics.

Questions on admission to CEAS or choosing a major should be directed to the Office of Student Services, (414) 229-4667.

## Civil Engineering Curriculum

The minimum number of credits required to complete the Bachelor of Science in Engineering with a major in civil engineering is 120.

Code	Title	Credits
<b>Engineering Core (23 Credits)</b>		
CIV ENG 203	Introduction to Solid Mechanics	4
CIV ENG 202	Dynamics	3
EAS 200	Professional Seminar	1
IND ENG 111	Introduction to Engineering <sup>1</sup>	3
IND ENG 112	Computer-Aided Design <sup>1</sup>	3
IND ENG 360	Engineering Economics	3
IND ENG 367	Engineering Statistics	3
MECHENG 320	Introduction to Fluid Mechanics	3
<b>Major Requirements (29 Credits)</b>		
CIV ENG 250	Engineering Surveying	3
CIV ENG 335	Soil Mechanics	3
CIV ENG 372	Introduction to Structural Design	4
CIV ENG 411	Engineering Principles of Water Resources Design	3
CIV ENG 413	Environmental Engineering	3
CIV ENG 431	Materials of Construction <sup>2</sup>	3
CIV ENG 490	Transportation Engineering	3
CIV ENG 480	Software Applications for Civil Engineering	3
CIV ENG 494	Principles of Civil Engineering Design	1
CIV ENG 495	Senior Design <sup>3</sup>	3
<b>Mathematics Requirement (16 Credits) <sup>3</sup></b>		
MATH 231	Calculus and Analytic Geometry I	4
MATH 232	Calculus and Analytic Geometry II	4
MATH 233	Calculus and Analytic Geometry III	4
ELECENG 234	Analytical Methods in Engineering	4
<b>Chemistry Requirement (5 Credits)</b>		
CHEM 105 or CHEM 102	General Chemistry for Engineering General Chemistry	5
<b>Physics Requirement (8 Credits)</b>		
PHYSICS 209 & PHYSICS 210	Physics I (Calculus Treatment) and Physics II (Calculus Treatment)	8

<b>Technical Electives - Select 18 credits from approved lists</b>		<b>18</b>
<b>GER Distribution Requirement (15 Credits)</b>		
Select 3 credits in Art		3
Select 3 credits in Humanities		3
Select 6 credits of Social Science		6
ENGLISH 310	Writing, Speaking, and Technoscience in the 21st Century	3
Cultural Diversity - One of the arts, humanities, or social science courses selected must also meet the UWM cultural diversity requirement.		
<b>Free Electives - Select 6 credits of free electives</b>		<b>6</b>
<b>Students must also satisfy Oral and Written Communication (OWA) Part A <sup>4</sup></b>		<b>0-6</b>
<b>Students must also Satisfy the UWM Foreign Language requirements <sup>4</sup></b>		<b>0-8</b>
<b>Total Credits</b>		<b>120</b>

<sup>1</sup> MECHENG 110 and MECHENG 111 may substitute for IND ENG 111 and IND ENG 112 for students transferring from another engineering major.

<sup>2</sup> Civil engineering majors may take MATLENG 201 in place of CIV ENG 431.

<sup>3</sup> MATH 221, MATH 222 and two free elective credits may substitute for MATH 231, MATH 232 and MATH 233.

<sup>4</sup> See General Education Requirements (<https://catalog.uwm.edu/policies/undergraduate-policies/#bachelorsdegreegeneraleducation>).

## Technical Electives

A minimum of 18 technical elective credits are required. At least 12-18 credits are required from Group A Technical Electives and 0-6 credits from Group B Technical Electives. Normally a minimum of 12 credits will be taken in an area of concentration.

Code	Title	Credits
<b>Group A Technical Electives - Take 12 to 18 credits of Group A electives. All non-required Civ Eng courses 400-699 are Group A Technical Electives.</b>		
CIV ENG 311	Introduction to Energy, Environment and Sustainability	
CIV ENG 360	Introduction to Structural Analysis	
CIV ENG 401	Intermediate Strength of Materials	
CIV ENG 412	Applied Hydrology	
CIV ENG 431	Materials of Construction	
CIV ENG 455	Construction Planning, Equipment, and Methods	
CIV ENG 456	Foundation Engineering	
CIV ENG 463	Introduction to Finite Elements	
CIV ENG 466	Design of Composite Structures	
CIV ENG 492	Environmental Impact Assessment	
CIV ENG 502	Experimental Mechanics & Nondestructive Evaluation	
CIV ENG 511	Water Supply and Sewerage	
CIV ENG 521	Water Quality Assessment	
CIV ENG 555	Sustainable Construction Materials and Technologies	
CIV ENG 560	Intermediate Structural Analysis	

CIV ENG 571	Design of Concrete Structures
CIV ENG 572	Design of Steel Structures
CIV ENG 573	Design of Masonry and Wood Structures
CIV ENG 574	Design of Prestressed Concrete Structures
CIV ENG 579	Earthquake Engineering
CIV ENG 590	Urban Transportation Planning
CIV ENG 592	Traffic Control
CIV ENG 594	Physical Planning and Municipal Engineering
CIV ENG 596	Transportation Facilities Design
CIV ENG 598	Pavement Analysis and Design
CIV ENG 610	Introduction to Water and Sewage Treatment
CIV ENG 614	Hazardous Waste Management
CIV ENG 616	Computational Hydraulics and Environmental Flows
CIV ENG 691	Topics in Civil Engineering:

### Group B Technical Electives

Select no more than 6 credits from the following list:

Any Chemistry course 200-level or above	
Any Engineering or Mathematics course at the 400-level or above	
Any Physics course 300-level or above	
CHEM 104	General Chemistry and Qualitative Analysis <sup>1</sup>
COMPSCI 250	Introductory Computer Programming <sup>2</sup>
EAS 1	Engineering Co-op Work Period <sup>3</sup>
EAS 208	College of Engineering and Applied Science Internship Course <sup>3</sup>
ENGLISH 206	Technical Writing
ELECENG 301	Electrical Circuits and Electronics I
GEOG 215	Introduction to Geographic Information Science
GEOG 403	Remote Sensing: Environmental and Land Use Analysis
MATH 313	Linear Programming and Optimization
MATH 322	Introduction to Partial Differential Equations
PHYSICS 214	Lab Physics I (Calculus Treatment)
PHYSICS 215	Lab Physics II (Calculus Treatment)
URBPLAN 591	Introduction to Urban Geographic Information Systems (GIS) in Planning

<sup>1</sup> Students who take CHEM 104 satisfy 3 credits of Group B Electives.

<sup>2</sup> COMPSCI 202 Introductory Programming Using Python is an acceptable alternative.

<sup>3</sup> Students may apply a maximum of 3 credits from either cooperative education (EAS 1) or internship (EAS 208) experiences toward approved technical electives.

## Areas of Concentration

The Civil & Environmental Engineering Department offers numerous elective courses that allow students to work in one of four areas of concentration.

Code	Title	Credits
<b>Geotechnical Engineering</b>		
Students in this concentration should complete:		
CIV ENG 456	Foundation Engineering	
And at least three of the following courses:		
CIV ENG 360	Introduction to Structural Analysis	
CIV ENG 401	Intermediate Strength of Materials	
CIV ENG 412	Applied Hydrology	
CIV ENG 463	Introduction to Finite Elements	
CIV ENG 492	Environmental Impact Assessment	
CIV ENG 598	Pavement Analysis and Design	
<b>Municipal and Transportation Engineering</b>		
Students in this concentration should complete at least three of the following:		
CIV ENG 492	Environmental Impact Assessment	
CIV ENG 590	Urban Transportation Planning	
CIV ENG 592	Traffic Control	
CIV ENG 594	Physical Planning and Municipal Engineering	
CIV ENG 596	Transportation Facilities Design	
CIV ENG 598	Pavement Analysis and Design	
CIV ENG 610	Introduction to Water and Sewage Treatment	
<b>Structural Engineering</b>		
Students in this concentration should complete:		
CIV ENG 360	Introduction to Structural Analysis	
CIV ENG 401	Intermediate Strength of Materials	
And at least two of the following courses:		
CIV ENG 431	Materials of Construction	
CIV ENG 456	Foundation Engineering	
CIV ENG 463	Introduction to Finite Elements	
CIV ENG 466	Design of Composite Structures	
CIV ENG 560	Intermediate Structural Analysis	
CIV ENG 571	Design of Concrete Structures	
CIV ENG 572	Design of Steel Structures	
CIV ENG 573	Design of Masonry and Wood Structures	
CIV ENG 574	Design of Prestressed Concrete Structures	
CIV ENG 579	Earthquake Engineering	
<b>Water Resources and Environmental Engineering</b>		
Students in this concentration should complete at least three of the following:		
CIV ENG 311	Introduction to Energy, Environment and Sustainability	
CIV ENG 412	Applied Hydrology	
CIV ENG 511	Water Supply and Sewerage	
CIV ENG 521	Water Quality Assessment	

CIV ENG 610	Introduction to Water and Sewage Treatment
CIV ENG 614	Hazardous Waste Management

## Civil Engineering BSE Objectives and Outcomes

### Program Educational Objectives

The Civil Engineering program educational objectives prepare students to:

**Objective 1.** Graduates apply broad based knowledge of mathematics, science and engineering science for solving engineering problems and creating engineering designs in the civil engineering professional field.

This objective implies that graduates will have a solid preparation that includes the knowledge of mathematics, sciences, statistics, engineering science disciplines and computer applications as a foundation for later studies and life-long learning. Through a rigorous program preparation graduates will also be well versed in different ways of addressing engineering problems.

**Objective 2.** Graduates demonstrate leadership in infrastructure design by creating solutions for complex urban problems by synthesizing and implementing knowledge from multiple disciplines.

This objective implies that graduates will have the necessary breadth and depth of technical knowledge and professional training to sustain a lengthy career as a civil engineer. It also encompasses broad knowledge of four traditional fields of civil engineering with an in-depth specialization knowledge in one focus area, as well as proficiency in experimentation, design, professional tools, communication skills, relationships between the engineering design and legal, environmental and societal concerns.

**Objective 3.** Graduates are leaders in the workplace and in professional organizations by demonstrating effective communication skills, ethical responsibility, and social awareness.

This objective relates to the nontechnical aspects of professional practice. Included in professional preparation are ethics, participation in professional organizations, interactions between professionals and integrating non-engineering factors in designs and decisions.

**Objective 4.** Graduates adapt to changes in the urban and global environment by exhibiting intellectual curiosity, innovating, pursuing continuous education, and embracing diverse ideas.

This objective recognizes the speed of technological change, changing professional environments and the need to keep the program up to date, both in terms of the knowledge transmitted and the means by which it is transmitted.

### Student Outcomes

The BSE program in Civil Engineering will prepare students to attain:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

3. an ability to communicate effectively with a range of audiences.
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

## Minimum Requirements

Students must maintain an average GPA of at least 2.00 on all work attempted at the University and in all courses offered by the College. Students majoring in biomedical engineering, computer engineering, computer science, industrial engineering, and materials engineering must maintain an average GPA of at least 2.00 in all 300-level and above courses in the student's major department. Students majoring in civil engineering, electrical engineering, and mechanical engineering must maintain an average GPA of at least 2.50 in all 300-level and above courses in the major department. Transferable courses will be included as appropriate. Advancement to major status is required for graduation.

In order to provide maximum flexibility while preserving the institutional identity of a UWM degree, the College requires residence:

1. during the last 30 credits, or
2. during 45 of the last 60 credits, or
3. during any 90 credits of a student's undergraduate career.

At least 15 credits of advanced work in the major must be completed in residence at UWM.

For the Engineering BS program only:

1. complete at least 30 credits at UWM; and
2. complete at least 15 credits in upper-division (numbered 300 or above) courses in the major at UWM.

A student who does not maintain continuous registration during the academic year and is re-admitted to the College must meet the program and graduation requirements in effect at the time of re-entry.

Degree and major requirements must be completed within 10 years of initial enrollment at UW-Milwaukee. Should students not complete the major within the 10-year time frame, the students will switch to the most current degree and major requirements. A new 10-year time frame would then begin.

## Dual Majors

Students wishing to major in more than one field can do so in two ways:

1. Complete the requirements for more than one major before receiving a degree from the College. In this case, the degree will list both majors.
2. Be admitted to the College as a second degree candidate (after earning a bachelor's degree in any field), providing University and College entrance requirements are met. Such a student must meet

all undergraduate degree requirements in the College and present a minimum of 30 credits beyond the previous bachelor's degree.

## Concurrent Registration at Other Institutions

CEAS students wishing to establish concurrent enrollment at another institution must obtain prior permission from their academic advisor.

## Student Academic Appeals

Students may appeal an academic action to the Office of Student Services. An appeal is a request for an exception to an established policy or rule. The content of each appeal is carefully reviewed in order to reach a decision. Appeals should be submitted in writing to the Office of Student Services. The appeals committee considers individual cases concerning the degree requirements and other academic rules and regulations established by the College of Engineering and Applied Science faculty.

The College of Engineering and Applied Science has established written procedures for undergraduate student academic grievances. Copies of the grievance procedure are available in the Office of Student Services. As a first step, students must discuss the grievance with the faculty member or administrator as soon as possible to attempt to resolve the issue, but not later than 30 days after the action that prompted the grievance/appeal.

## Computer Science and Engineering Programs

Detailed descriptions of the CEAS undergraduate programs are provided in this catalog. All courses are not offered every semester. A few technical elective courses may be offered only once every three to four semesters. In addition, since computer science and engineering curricula are continually evolving to keep current, students are encouraged to consult with their advisors to plan each semester's list of classes. Part-time students should always maintain a plan that looks ahead two to three semesters to avoid scheduling difficulties.

The curricula outlined in the pages are applicable to new students entering CEAS in fall 2016 or later. Students who enrolled in computer science or engineering programs prior to that date should consult with the appropriate previous editions of this catalog for information about their program requirements. As a general rule, when program changes occur, continuing students have the choice of continuing in their existing program or following the new requirements. Occasionally, a program change will be required of all students regardless of their date of matriculation, so long as it does not increase the total credits needed for graduation.

These program descriptions represent the minimum requirements for graduation from UWM in computer science or engineering. In all cases, it is important that students consult with their advisor before making course selections to avoid errors in programming.

## Academic Advising

The Office of Student Services in the College of Engineering and Applied Science, located in Room E386 of the Engineering and Mathematical Sciences Building, offers undergraduate students academic advising from professional advisors who are familiar with the curriculum, College requirements, and the special needs of engineering and computer science students. These advisors provide services such as freshman orientation,

course selection, program planning, and credit transfer evaluation. Students are assigned to a permanent professional advisor as soon as they are accepted into the College, and are urged to confer with their advisor at least once each semester. Students also are assigned to a faculty advisor who provides technical expertise specific to the student's area of study.

We understand that it can be a delicate balance managing school, work, family, and active social lives. The College of Engineering and Applied Science advisors are here to help you achieve that balance.

You will be assigned a professional academic advisor upon being admitted to the College of Engineering & Applied Science. Your advisor will work with you throughout your undergraduate experience, providing guidance on:

- course registration,
- graduation planning,
- career preparation,
- and serving as a liaison to the many other resources available on our campus.

Advisors are also a great source of information on student organizations, tutoring and scholarship opportunities.

In addition to professional academic advisors, you will also have access to faculty advisors. These advisors can provide insights into the technical aspects of the engineering and computer science curricula while mentoring you as you define your professional goals.

## Joint Programs with Other Campuses

### Pre-engineering

Qualified students may enroll in coordinated pre-engineering programs at UW-Green Bay, UW-Parkside, and UW-Waukesha for two years of pre-engineering coursework. These coordinated programs ensure equivalent coursework, appropriate advising, and early access to the Cooperative Education Program at UWM.

### Dual Degree Programs

Qualified students may enroll in coordinated dual degree programs at Alverno College, Carroll University, UW-Eau Claire, UW-Green Bay, UW-La Crosse, UW-Oshkosh, UW-Stevens Point, UW-Whitewater and Wisconsin Lutheran College. Students in these programs will earn a bachelor's degree at both universities in five years. Students transfer to UWM after three years at the partner university. For more information, contact the Office of Student Services at (414) 229-4667.

## Joint Programs with Wisconsin Technical Colleges

### Gateway Technical College

An agreement with GTC allows those students having associate degrees in the Electrical Engineering - Technology the opportunity to be given credit for courses required in the UWM bachelor of science in engineering program. For more information, contact the Office of Student Services at (414) 229-4667.

### Milwaukee Area Technical College

An agreement with MATC allows joint admission and enrollment at MATC and CEAS. Qualified students may take English, mathematics, chemistry, and general education courses at MATC. The program ensures equivalent

coursework and appropriate advising. Students complete a bachelor of science degree in engineering or computer science at UWM.

## Waukesha County Technical College

An agreement with WCTC allows those students having associate degrees in the Industrial Occupations Division at WCTC the opportunity to be given credit for courses required in the UWM bachelor of science in engineering or bachelor of science in computer science program. For more information, contact the Office of Student Services at (414) 229-4667.

## Honors in the Major

Students in Civil Engineering who meet all of the following criteria can be awarded honors in the major upon graduation:

1. A 3.000 cumulative GPA in all UWM graded credits;
2. A 3.500 GPA over all upper-division (300-level and higher) Civ Eng courses;
3. Participation in the Accelerated MS Degree program with successful completion of 6 credits at the undergraduate level that can apply towards the MS degree program.

## College of Engineering and Applied Science Dean's Honor List

GPA of 3.500 or above, earned on a full-time student's GPA on 12 or more graded credits in a given semester.

## Honors College Degree and Honors College Degree with Distinction

Granted to graduating seniors who complete Honors College requirements, as listed in the Honors College (<https://catalog.uwm.edu/honors-college/>) section of this site.

## Commencement Honors

Students with a cumulative GPA of 3.500 or above, based on a minimum of 40 graded UWM credits earned prior to the final semester, will receive all-university commencement honors and be awarded the traditional gold cord at the December or May Honors Convocation. Please note that for honors calculation, the GPA is **not** rounded and is truncated at the third decimal (e.g., 3.499).

## Final Honors

Earned on a minimum of 60 graded UWM credits: Cum Laude - 3.500 or above; Magna Cum Laude - 3.650 or above; Summa Cum Laude - 3.800 or above.